Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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DOUGLAS McKAY, Secretary

FISH AND WILDLIFE SERVICE

JOHN L. FARLEY, Director

Commercial Fisheries Abstracts

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The abstracts in this leaflet may be left in their present form; but it is suggested that to make the most efficient use of them, they be cut out on the lines designated and filed by the number in the upper left-hand corner of each. For a full description of this filing system see "Fishery Technological Abstract Card System" by Maurice E. Stansby and K. L. Osterhaug, Fishery Leaflet No. 232, obtainable free by request from Fish and Wildlife Service, Washington 25, D. C.

In addition to the regular abstracts, there is included a bibliography of references of secondary importance (without abstracts). These may be cut off on the lines designated and pasted on standard 3 x 5-inch cards for filing.

Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

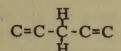
0	General and theoretical	5	Vitamins
1	Fish by species	6	Fishery byproducts
2	Fresh fish	7	Analytical Methods
3	Preserved fish	8	Composition
4	Oils	9	Miscellaneous

Issued with the approval of the Bureau of the Budget, December 29, 1953

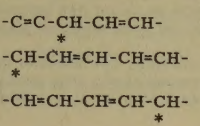
4.5 FAT RANCIDITY: RECENT STUDIES ON THE MECHANISM OF FAT OXIDATION IN ITS RELATION TO RANCIDITY

Morris, Steward G.
Journal of Agricultural and Food Chemistry 2, No. 3, 126-132 (February 3, 1954)

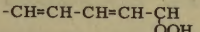
The mechanism of fat oxidation, which is responsible for rancidity, is a chain reaction involving radicals formed at the α-methylene groups adjacent to the double bonds. The free radicals then react with oxygen to form hydroperoxides. The formation of free radicals from fat molecules is dependent on hydrogen lability. For example, linoleic acid has an unsaturated pattern of the following type:



This structure has a high degree of hydrogen lability and forms a resonance of three equivalent free radical structures. These structures are:



The active carbon * of the free radical in turn reacts with oxygen to form a hydroperoxide with this representative structure:



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 ABSTRACTER: W. N. Sumerwell

4.64 EXPANDING USES OF ANTIOXIDANTS

Tappel, A. L.
Food Engineering 26, No. 6, 73-75, 133-134 (June, 1954)

Rancidity caused by the oxidation of unsaturated fats is one of the largest problems in the preservation of fats and fatty foods. This rancidity produces aldehydes and ketones that have strong and undesirable odors and tastes. Means of controlling rancidity other than by the use of antioxidants should be adopted where possible, e.g., natural fats that are more saturated or even hydrogenated fats should be used in preference to unsaturated fats wherever possible. Many oxidation problems can be solved by the reduction or elimination of oxygen through the use of air-tight containers sealed under a vacuum or with an inert gas. Also of importance in preventing oxidative rancidity are lower processing and storage temperatures and the reduction of light intensity by the use of opaque or brown transparent packages. Antioxidants can supplement these precautionary measures if maximum stability is desired.

Antioxidants suitable for stabilization of unsaturated fats are of two general types: (1) Phenolic antioxidants such as butylated hydroxyanisole (BHA), nordihydroguaiaretic acid (NDGA), propyl gallate, and the tocopherols. These inhibit fat oxidation by reacting with free radical intermediates of the oxidizing fats. (2) Synergists that have no direct effect upon fat oxidation but supplement the primary phenolic antioxidants, usually by forming stable chelates with trace metal contaminants, thereby removing these metals as fat oxidation catalysts.

Since no one antioxidant possesses properties ideal for a wide variety of applications, mixtures of antioxidants are very popular. For example, one mixture that is readily soluble in fats consists of 20% BHA, 6% propyl gallate, 4% citric acid and 70% proplyene glycol. In this mixture propyl

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 ABSTRACTER: Martin Heerdt

4.99 DIETARY FAT AND BODY FAT: THE COMPOSITION OF THE BACK FATS OF PIGS FED ON A DIET RICH IN COD-LIVER OIL AND LARD

Garton, G. A. and Duncan, W. R. H.
Biochemical Journal 57, No. 1, 120-125 (May, 1954)

Two normal Large White x Wessex litter-mate piglets were fed from weaning at 8 weeks on a diet containing, in addition to other ingredients, a fat mixture consisting of equal parts by weight of lard and cod-liver oil. The quantity of fat mixture in the diet was gradually increased until, by the time the pigs were 15 weeks old, their diet consisted of 50% by weight of the fat mixture. At the end of the 15th week the pigs became edematous; they were then killed and examined.

The inner- and outer-back fats were found to be dark brown and oxidized to a considerable degree. The back fats of one of the pigs were crystallized from acetone at -40°C. and two fractions were obtained. The first of these, an acetone-insoluble glyceride fraction with an iodine value approximating that of lard, represented 68% of the total back fat. The second, an acetone-soluble glyceride fraction of much higher mean unsaturation, represented 32% of the total back fat.

Determination of the fatty acid composition of the acetone-insoluble glyceride fraction showed that this fraction resembled normal pig fat except for the presence of more than the usual quantity of unsaturated acids of the C_{16} and C_{20} series. The fatty acid composition of the acetone-soluble glycerides, in contrast, resembled the saturated fatty acid content of cod-liver oil, but contained less polyethenoid C_{20} and C_{22} fatty acids and a correspondingly larger quantity of C_{16} and C_{18} unsaturated acids.

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 ABSTRACTER: Martin Heerdt

6.69 OBTAINING PHOSPHATIDES FROM COLD-BLOODED ANIMALS

Delleske, Heinz
German 812,388 (August 30, 1951)
Chemical Abstracts 47, No. 13, 6612 (1953)

Phosphatides, heretofore limited in source to readily extractable egg yolk, rape seed, etc., are obtained from the tissues of cold-blooded animals. The starting material (dry or fresh) is washed with water, dried, extd. with hot Me_2CO, again dried, and extd. with cold CH_3OH to give almost quant. extn. of the phosphatides. The alc. ext. is then treated with suitable absorption material such as charcoal under vacuum. For example, 1500 kg. of herring roe is dried, washed with agitation to remove sol. albumin, salts, colored material, fishy taste, and odor. The product (450 kg.) is dried under vacuum to remove cellular complexes and extd. with hot Me_2CO to remove fats and cholesterol. The residue (350 kg.) is again dried to split the phosphatide albumin complexes, treated with 600 l. CH_3OH at room temp. for 3 hrs. with stirring, and 12 hrs. without stirring. The alc. soln. is removed and 600 l. of fresh CH_3OH is added with stirring for 3 hrs. The alc. exts. are treated with activated charcoal and the alc. soln. is removed under vacuum at 30°. Yellow-brown, odorless, and hygroscopic material (19.8 kg.) is obtained contg. lecithin, cephalin, and other phosphatides and unsaturated acids. This material is easily absorbed, and more easily digested than egg-yolk lecithin. Most organs of cold-blooded animals such as fish and crustaceans, especially the roe, testicles, and cerebral organs may serve as source materials either in the fresh or preserved states.

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MECHANISM OF FAT OXIDATION

DIETARY FAT AND BODY FAT

EXPANDING USES OF ANTIOXIDANTS

PHOSPHATIDES FROM FISH

4.99 (Cross Reference: 8.53)

The authors concluded, therefore, that the lard and the cod-liver oil were absorbed essentially unchanged and then deposited additively in the depots along with typical 'synthesized' pig fat. The depletion of vitamin E, which can function as an antioxidant, is believed to have resulted in the oxidation of the polyethenoid fatty acids of the cod-liver oil.

4.5

The hydroperoxides react with more oxygen to form diperoxides. The diperoxides decompose to yield a mixture of decomposition products including aldehydes.

The oxidation mechanism of monoenoic acids, such as oleic acid, is not understood as well as that of the dienoic acids but it is known that free radical formation and hydroperoxide formation are involved.

The oxidation of trienoic systems differs from both monoenoic and dienoic systems. From studies on linolenic acid it is believed that dimer formation takes place during oxidation and that more than half of the double bonds present are destroyed by polymerization.

By the use of new and improved technics such as chromatography, counter-current distribution, polarigraphic methods, and ultraviolet and infrared spectrophotometry, considerable information has been and is being obtained concerning the structure and identification of fat oxidation products.

4.64

gallate is in synergistic combination with BHA and citric acid. The mixture also has carry-through properties due to the presence of heat-stable BHA.

A number of new antioxidants have been proposed for food use. Two of these are (1) Di-t-butyl-p-cresol (DBPC) and (2) 1,6-Di-t-butyl-4 methyl phenol, which is at present widely used for non-edible fats and hydrocarbons. The latter product has recently been approved by the Food and Drug Administration for use in foods. DBPC is heat-stable. Some other antioxidants that may eventually prove economically useful are: norconidendron, a polyphenolic antioxidant that can be prepared from sulfite waste liquor of the western hemlock; dihydroquercetin, which is isolated from the bark of the Douglas fir and Jeffrey pine and has antioxidant properties similar to propyl gallate; and an anti-oxidant from the fruit of the Osage orange.

Fatty fishes, turkeys, and pork, all of which contain highly unsaturated fats, have presented the greatest problems in fat oxidation with animal products. For instance, the addition of anti-oxidants to herring subsequently held in cold storage did not produce any significant results. Bacon sides dipped in lard containing BHA have shown only a small increase in stability, whereas BHA incorporated in creamed turkey held in frozen storage greatly improved the stability of the fat and aided in the retention of flavor.

8.51 THE AMINO ACID CONTENT OF ROE AT DIFFERENT STAGES OF MATURITY FROM THE FIVE SPECIES OF PACIFIC SALMON

Seagran, Harry L.; Morey, David L.; and Dassow, John A.
Journal of Nutrition 53, No. 1, 139-149 (May, 1954)

The "essential" amino acid content of roe (eggs) at different stages of maturity from the five species of Pacific salmon was determined by microbiological methods. The purpose of the study was to make possible a comparison between the quality of salmon roe protein and other protein supplements commonly used for hatchery fish and other animal feeds.

The relative distribution of amino acids in the roe was generally uniform, being significantly altered (statistically) only by maturity. Most of the amino acids were present in increasing quantities with increasing maturity. The arginine and tryptophan levels proved quite constant, however, whereas the threonine content decreased with maturity. These trends were much more noticeable during the most immature stages of the roe.

Since the "essential" amino acid content of salmon roe was found to be very similar to that for beef liver and pink salmon viscera (common hatchery fish feeds), it is difficult to explain the effectiveness of salmon roe as a hatchery feed solely on the basis of amino acid content.

The amino acid values reported in this paper are summarized in Table 1.

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 ABSTRACTER: Harry L. Seagran

9.2 NFI TOPICS: FISH STICKS, TUNA, AND REEFER SHIPS

Anonymous
Food Engineering 26, No. 6, 235-236 (June, 1954)

Fish sticks, tuna, and fishing vessels equipped for freezing fish on board were the subject of recent talks at the National Fisheries Institute Meeting in Cleveland, Ohio. One of the biggest boons to the fishing industry recently has been the introduction of fish sticks made from popular types of fish. These sticks are cut from blocks of frozen fillets, dipped in batter, breaded, and cooked in deep fat. The 1953 production of fish sticks exceeded 7.5 million pounds, whereas the first 3 months' production of 1954 has already exceeded 9.0 million pounds.

Tuna also is a fast growing item. The annual pack in 1953 was 10 million cases as compared with a pre-World War II pack of 3 million cases. It now appears that western coastal waters are not a natural feeding ground for tuna. There are, however, indications that the mid-Pacific is a natural feeding ground. The Fish and Wildlife Service is investigating methods of catching tuna in large volume over short periods of time. Large quantities of so-called bluefin tuna weighing 25 to 50 pounds each are to be found in the New England coastal waters. It is hoped that more Pacific Coast tuna boats will be attracted to New England waters.

The Fish and Wildlife Service also is encouraging the use of freezing equipment on board the vessels. Whole fish frozen at the time of catching may be processed later on shore. The advantages of this system are: (1) full boats returning with highest quality products, and (2) a smoothing out of the processing operation with its accompanying economies.

 ABSTRACTER: Martin Heerdt

6.69 MUSCLE RIBOSIDE HYDROLASES: PREPARATION AND PROPERTIES

Tarr, H. L. A.
Federation Proceedings 13, No. 1, Part I, 309-310 (March, 1954)

Work previously reported (Federation Proc. 12: 279, 1953) has been continued and riboside hydrolase enzyme preparations have been obtained from the muscles of certain Pacific fish by the following procedure, all manipulations being carried out at about 0°C. Muscle tissue is blended with 0.5-0.6 M KCl or NaCl and 1.0 N HCl is added to pH 4.6. The neutralized supernatant obtained on centrifuging is fractionated with ammonium sulfate, the 0.4-0.6 saturated fraction exhibiting most of the riboside hydrolase activity. These crude fractions are dialyzed and on paper electrophoresis at pH 8.6 yield two zones, one which does not migrate at all and the other which migrates toward the anode. Further fractionation of these crude preparations is achieved by stirring with Amberlite XE 64 resin in 0.2 M phosphate pH 7.0. On washing the resin repeatedly with water and finally eluting with 2.5 M NaCl, preparations are obtained which hydrolyse inosine about 650 times as actively as the original muscle. These preparations are not quite homogeneous electrophoretically, but the major component does not migrate at all and appears to be denatured. They are most active at pH 5.6 and hydrolyse purine ribosides and cytidine but not uridine. Another fraction is obtained by re-fractionation of the supernatant from the resin treatment with ammonium sulfate. This fraction is rather crude and is active at pH 5.6 and above 8.0. All riboside hydrolase activity is destroyed by a brief exposure to a weak electric field (e.g. 64 v. and 2 ma at 0°C.). It appears that 2 enzymes are concerned, one with a pH optimum of 5.6 and another with a pH optimum of about 8.5.

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7.80 SENSORY TEST METHODS. I. THE TRIANGLE INTENSITY (T-I) AND RELATED TEST SYSTEMS FOR SENSORY ANALYSIS

Davis, John Gorton and Hanson, Helen L. (Western Utilization Board, U. S. Department of Agriculture, Albany, California)
Food Technology 8, No. 7, 335-339 (July, 1954)

The triangle test, which is made up of three samples of which two are duplicates, is widely used for determining the probability that a difference exists between the duplicates and the odd sample. Much information is lost in the use of this test if intensity designation is not made or if it is utilized only for those judgments in which the odd-sample choice is correct.

If the only information requested in the test is the selection of the odd sample, the probability of correct selection by chance is 1/3. If the tester is required to judge whether the odd sample is stronger or weaker in intensity of some particular quality, the probability of a correct selection by chance is reduced to 1/6. Thus, the requirement that the intensity of some property of the sample be designated decreases the number of tests required to detect a difference.

The experience of Byer and Abrams and of those at the authors' laboratory has shown that partially correct intensity designations were made in significantly greater numbers than would be expected by chance in the cases in which odd-sample selection was incorrect. Hence, there was a need for a method of analysis that utilized partially correct judgments as well as those that were completely correct.

This paper therefore presents a new method for the evaluation of results of triangle tests in which the designation of the intensity is required. All judgments, whether partially or completely correct,

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 ABSTRACTER: F. Bruce Sanford

6.69 (Cross Reference: 0.38)

7.80

are evaluated in terms of an "I value" that is directly related to the probability of chance occurrence of the judgments. Since this method differs considerably from the presently accepted version of the triangle test, the method is referred to as the T-I test (triangle-intensity).

8.51 (Cross Reference: 1.30)

Table 1. Amino Acid Content of Salmon Roe
(Values given as percent of protein, calculated to 16% N)

	Chum	Coho	King				Pink	Sockeye
Maturity Grade [1]	3	3	1	2	3	4	3	3
Arginine	6.8	7.0	7.5	7.3	7.7	7.5	7.3	7.2
Histidine	2.8	2.8	2.3	2.5	2.6	2.5	2.8	2.7
Isoleucine	7.3	7.5	5.6	6.7	6.8	7.2	7.1	7.5
Leucine	9.8	10.0	8.2	9.3	9.4	9.8	9.9	10.2
Lysine	8.8	8.8	7.1	8.4	8.8	8.8	8.9	8.5
Methionine	2.9	2.7	2.6	2.8	3.0	3.0	2.8	2.8
Phenylalanine	4.8	4.9	4.4	4.9	4.8	4.8	5.0	4.8
Threonine	6.1	5.9	6.0	5.7	5.8	5.8	5.7	5.8
Tryptophan	0.9	0.9	0.9	0.8	0.9	0.8	1.0	0.9
Valine	7.1	7.1	6.1	7.0	7.0	7.1	7.7	7.3

[1] An arbitrary scale indicating the degree of sexual maturity. Grade-1 roe are very immature; grade-4 roe are very mature.

9.2 (Cross References: 3.230, 1.1)

3.238 NORWEGIAN FIRM FREEZES HERRING IN ALGINATE JELLY

Anonymous
U. S. Department of the Interior, Fish and Wildlife Service, Fishery Products Report No. S-131, Seattle, Washington, July 8, 1954

The development of a new method of freezing herring in alginate jelly was announced recently by a leading seaweed processing firm in Drammen, Norway, the Norwegian Information Service (May 27) reports. Preserving the herring from one season to another, the patented method is receiving practical application at four Norwegian herring plants. Formerly, because of the high fat content, herring could be kept fresh no longer than half a year at the most.

At a demonstration in Kristiansund recently, herring frozen in alginate jelly for 12 months was served to a critical gathering of herring experts, chemists, housewives, and representatives of the firm which has tested the new method. The consensus, according to the Norwegian Journal of Commerce and Shipping, was that the year-old herring tasted better than fresh. For one thing, the new product is devoid of the characteristic herring odor.

Packed in alginate jelly and wrapped in cellophane, the filleted herring will be introduced to Norwegian consumers next year. The fillets will be available in packages of half a kilogram (1.1 pounds) for retail distribution, and in 2 to 8 kilogram (4.4 to 17.6 pounds) packages for larger families and institutions. Experiments have also been made with freezing whole herring and mackerel in alginate jelly. The frozen mackerel has attracted considerable interest among foreign importers.

The demonstration in Kristiansund was held at Industrialaboratoriet A/S, a research institution sponsored by the Klippfish Exporters National Association and Norwegian Frozen Fish A/S. For

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UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE.

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3.230 GOOD FRYING PRACTICES

Robertson, C. J. (Proctor and Gamble Company, Cincinnati, Ohio)
A talk made before the New England Fish Technologist's Society in Boston, October 13, 1953

A new industry, the manufacture of frozen fried fish and shellfish, is springing up within the field of food technology. The advantages of frozen fried seafood include the fact that it places a wide selection of fish in the fried form at the finger-tips of the homemaker. Available in the freezer cabinet of the supermarket are scallops, perch, oysters, cod, haddock, fish cakes, crab cakes, soft-shell crabs and various types of fish sticks. This type of product has rendered the homemaker a real convenience in making fried fish available for her table with an absolute minimum of effort on her part.

It is a challenge to the industry to see that only high-quality products are released for sale. It is not enough for some or even for most processors to produce high-quality products, for at this critical period, only one low quality brand can prejudice the housewife against all similarly processed fishery products.

One of the most crucial factors in putting out a high-quality fried product is the understanding and utilization of good frying practices.

Good frying practices, reduced to the simplest terms consist of: (1) Choosing the highest quality raw ingredients; (2) Keeping to a minimum the changes which normally occur in fats under frying conditions; (3) Compensating as much as possible for the changes that do occur.

The following is offered as a check-list of do's and don't's of good frying practice:

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COMMERCIAL FISHERIES ABSTRACTS VOL. VII NO. 10 PAGE 5
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. ABSTRACTER: Kathryn L. Osterhaug

2.113 CATHODIC PROTECTION OF SHIPS AND MARINE STRUCTURES

Spencer, K. A.
Chemistry and Industry, No. 22, 627 (May 29, 1954)
Chemistry and Industry, No. 25, 702-708 (June 19, 1954)

The principles of cathodic protection are reviewed and practical applications to ships, jetties, sheet piling, buoys, pontoons and floating docks are presented. The author emphasizes that cathodic protection is an adjunct to protective paint coatings rather than a replacement for them in preventing the corrosion of submerged metals. The best paint coatings leave a minimum of bare steel to be protected and minimize the amount of current flow and anode metal required.

There are both advantages and disadvantages to using galvanic anodes such as magnesium or graphite anodes with direct power. Technical and/or economic considerations favor the use of galvanic anodes for the interior of tankers and the exterior of small vessels and mooring buoys, whereas the power impressed system is preferred for jetties, sheet piling, or the submerged exterior of large vessels, particularly if they are inactive. Each vessel or structure, however, requires individual study.

The advantages of using the thicker hot applied coal tar or petroleum asphalt base enamels for permanently submerged metals such as jetty piles has been proved by experience. On active vessels the anode should be close to the cathode surface, e.g., attached to bilge keels. Alkalinity and gas formation adjacent to the anodes on the vessel's hull tends to remove the paint. This exposure of metal short-circuits the flow of current from the rest of the vessel; consequently, resistant protective coatings are needed around the anodes. By applying long-lasting coating patches around the anodes and long-lasting anti-fouling compounds to the vessel, it is possible to extend the dry-drocking interval to two years on cathodically-protected vessels.

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UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. ABSTRACTER: Martin Heerdt

2.113 PROTECTIVE COATINGS FOR SHIPS AND MARINE INSTALLATIONS

Hudson, J. C.
Chemistry and Industry, No. 22, 626 (May 29, 1954)
Chemistry and Industry, No. 23, 640-651 (June 5, 1954)

Protective coatings are of considerable practical value on steel vessels and other marine structures; however, local corrosion can be minimized by good structural design. Ordinarily, differences in the type of structural steel used do not have any major effect on the behavior of the protective coating.

The primary factor influencing the behavior of coatings is the preparation of the steel surface. Durability of protective paints on steel surfaces exposed to the atmosphere can be improved greatly by removing the mill scale from the steel prior to painting. This scale may be removed from the steel either by pickling or by grit-blasting. Any protective coating applied to steel should be at least 0.005 inches thick when applied to structures above the water line or 0.007 inches thick when applied on ships' bottoms.

The characteristics and properties of the most important types of paint and non-ferrous metal coatings for protecting steel against corrosion by the weather, by sea water, and by the soil are described by the author. Examples of severe corrosion and of efficient protection under marine conditions are also outlined.

The chief advantage of chlorinated rubber paints, which in some circumstances have appeared to have poor adhesion, is their resistance to hydrolysis by cathodically-produced alkali. Such paints are better suited for use in especially corrosive conditions and for under water applications than for

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3.230

"1. Use the correct frying fat.
2. Use the proper frying equipment -- equipment designed to insure a proper frying life.
3. Keep equipment functioning properly by frequent check-up.
   a. Correct any development of hot spots.
   b. Keep thermostats accurate.
   c. Replace worn coils, heating elements, etc.
   d. Repair worn spots or holes in kettles where heat is applied.
4. Clean frying kettle and equipment as needed to remove gum accumulation and dirt.
5. Clean hood over frying equipment and avoid return to the kettle of drippings which accumulate and condense on the hood.
6. Rinse all equipment thoroughly after cleaning to remove traces of materials used for cleaning.
7. Prepare foods properly.
   a. Check to avoid excessive moisture.
   b. Check to avoid loose crumbs.
8. Fry properly
   a. Avoid scorching and burning fresh fat when adding it to an empty kettle. Use "low" heat for melting.
   b. Regulate the heating of the frying fat by adjusting heating elements and burners properly to avoid local overheating.
   c. Avoid holding fat at idling temperatures, or worse yet at high temperatures, unnecessarily.
   d. Avoid frying temperatures above 400° F.
   e. Check idling temperatures and keep them as low as possible.
   f. Maintain a rapid or high "fat turnover".
      (1) Avoid too much fat in the kettle for the amount of food being fried.
      (2) Avoid using too big a kettle for the amount of food being fried.
   g. Clarify the fat frequently to avoid accumulation of burned particles.
9. Avoid contamination with metals which hasten breakdown, not only in the kettle but in all auxiliary equipment with which the fat comes in contact."

2.113

the protection of structural steel exposed to the atmosphere. The anti-corrosive action of older types of paints is based on the inhibitive action of various pigments (or products derived from the pigments). These inhibitors can not function if the impermeability of the paint vehicle is high. This principle needs careful consideration in the formulation of new types of paints, because some modern paint vehicles possibly are too water-proof, and by acting as semi-permeable membranes they prevent the dissipation of alkali.

In some instances pickling is preferred to grit-blasting, since there is a tendency for paints to blister when applied to grit-blasted surfaces. This tendency can be reduced but not eliminated entirely by weathering or by using a phosphoric acid wash after grit-blasting. Performance on grit-blasted surfaces in raft trials was improved if an extra coat of paint was applied.

3.238 (Cross References: 3.249, 1.2)

more than a year, scientists of the laboratory checked the condition of the frozen herring at regular intervals. Similar tests have been made by the Norwegian Fisheries Directorate's Chemical-Technical Research Institute. In no instance has it been possible to detect any trace of rancidness or deterioration of flavor.

6.132 SMALL SCALE MANUFACTURE OF FISH MEAL

Sparre, T. (Norwegian Herring Oil and Meal Research Institute, Bergen, Norway)
FAO Fisheries Bulletin 6, Nos. 1-2, 1-17 (January/February-March/April, 1953)

The non-fat solids content of fish (protein and phosphate) usually will be 20%, whereas the fat content may be anything from less than 1% to more than 20%.

Fat Fish Processing. A good fish meal should not contain more than 10% moisture. If 500 kg. of raw fish containing 6% oil were processed into meal by the removal of 355 kg. of water, the resulting meal would contain 100 kg. solid material, 30 kg. fat (20%), and 15 kg. water (10%). There are two drawbacks to drying the fatty raw material directly: (1) the meal will be of inferior quality because of its high oil content, and commercially saleable oil cannot be obtained from the meal; and (2) to produce 145 kg. meal, 355 kg. water would have to be removed (nearly 2 1/2 times the weight of the meal). For these reasons fatty fish are generally given a preliminary cooking and pressing. If the cooking and pressing is done correctly, the moisture content of the presscake can usually be reduced to 50% or less. The one outstanding disadvantage of this method is that about 20% of the solid matter (protein) is dissolved in the liquor and lost for meal production. Cooking and pressing reduces the amount of water that needs to be evaporated to a quantity equal to the weight of the meal. This represents a large saving in fuel, drying equipment, and labor. To reduce the loss of solids inherent to the cooking/pressing processes, the defatted dilute press liquid may be concentrated (to about 50% solids) and sold as fish solubles. Aternatively, the press liquid may be reincorporated in the presscake and dried together with the cake to make "whole meal."

Lean Fish Processing. Lean fish (less than 3% fat) may be processed without cooking and pressing because an excessively high fat content meal does not result. If fish containing 1% fat is processed directly, a higher total yield of meal with an appreciably higher percentage of proteins is obtained.

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 ABSTRACTER: Martin Heerdt

6.134 DRYING EXPERIMENTS 1953/54. III. TECHNICAL INVESTIGATION OF STEAM DRYING

Gloppestad, E.; Arefjord, M.; and Sand, G.
Meldinger fra SSF, No. 3, 64-70 (May, 1954) (English summary)

The authors conducted certain drying experiments with the aid of a large cylindrical steam dryer mounted on trunnions. Air was introduced at the discharge end and removed by an exhaust fan at the intake end. The heat exchange surface inside the dryer consisted of 3 concentric rings of steam tubes of different diameters. Steam introduced through a head at the discharge end of the dryer was siphoned off through a steam trap at the intake end of the dryer.

An increase in the amount of air put through the dryer increased the capacity of the dryer considerably (tables 1 and 2, omitted). Diffusion and evaporation of water could be facilitated by minimizing the size of the particles put through the dryer. Evidence was obtained to indicate that the large-diameter heat-exchange-surface tubes were much more efficient than the small-diameter tubes.

Throughout the test period the experimental dryer functioned like a hot air dryer rather than like a steam dryer. Steam dryers are usually operated one-third full of meal and heat transfer from the tubes to the meal is of greater importance than it was in the case of the experimental dryer.

A discussion of the findings followed the presentation of data on the experimental dryer. Most of the people present at the discussion favored parallel flow of steam and condensate in place of concurrent flow as was used in the experimental dryer.

 ABSTRACTER: Martin Heerdt

6.193 FERMENTATION MEALS AS SOURCE OF UNIDENTIFIED CHICK GROWTH FACTORS

Schaefer, A. E.; Greene, R. D.; Sassaman, H. L.; and Wind, S.
Federation Proceedings 13, No. 1, Part I, 476 (March, 1954)

It has been previously reported by the Cornell laboratories (Poultry Sci. 32:551, 1953) that penicillin mycelium residue (PMR) appeared to be qualitatively comparable to fish solubles as a source of the unidentified chick growth factor(s). Also at the Informal Poultry Nutrition Conference in 1953 (Federation Meetings) the University of Wisconsin laboratories reported concentration of an unidentified chick growth factor(s) in streptomycin mycelium residue (SMR). Experiments were conducted in our laboratories with chicks fed both purified and practical types of basal diets. Supplementation of these diets with either 3% PMR or 3% SMR or both indicated that these fermentation residues stimulated chick growth beyond that obtained with antibiotic supplementation. Feeding a combination of 0.5% PMR and 0.5% SMR resulted in chick growth stimulation equal to and usually greater than that obtained with single or combined supplements of distillers solubles, whey and fish products. Fractionation of a growth stimulating factor in SMR has produced a considerable concentration and will be reported. On the basis of several tests, the fractions possessing unidentified growth factor activity supported an extra growth response on practical corn-soya rations of approximately 10%. With the purified diets a short-term 2-wk. assay was developed wherein a growth increment of approximately 30% was obtained. The results obtained in these experiments indicate a preliminary conclusion that PMR and SMR contain at least 2 chick growth stimulating factors. The SMR appears to be richer than PMR in one of the factors.

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5.111 WHAT'S THE MATTER WITH VITAMIN A ACID?

Anonymous
Journal of the American Oil Chemists' Society 31, No. 6, 23 (June, 1954)

Vitamin A acetate or palmitate is used in food and pharmaceutical preparations for supplying vitamin A because its characteristics are known.

Vitamin A acid, in contrast, is a puzzling vitamin about which very little is known. From vitamin studies, however, it has been learned that vitamin A acid appears to have the same potency as vitamin A when bioassayed by the rat growth method. The rat grows in a normal manner on vitamin A acid, but for unknown reasons the vitamin A ingested by the rat cannot be found. No matter how much of this compound is fed to the rat, no perceptible amount of either vitamin A acid or vitamin A is deposited in his tissues or organs. According to these findings vitamin A acid is unique, because the other known vitamin A-active compounds, including the carotenoids, are deposited as vitamin A in substantial quantities in the various tissues of rats and other animals.

Vitamin A acid does not appear to have any future in the food or pharmaceutical business. Time, however, may change conditions; and some day there may be a use for vitamin A acid.

 ABSTRACTER: Martin Heerdt

SMALL-SCALE FISH MEAL MANUFACTURE

UNIDENTIFIED CHICK GROWTH FACTORS

STEAM DRYING OF MEAL

VITAMIN A ACID

6.132

Whole meal obtained by direct drying is worth 30% more than ordinary meal. To obtain this higher yield, however, considerably more water must be evaporated.

Fish processed on a small scale should be cooked 20 to 25 minutes in boiling water in a 40- or 50-gallon steel drum heated directly over a fire or until the protein is thoroughly coagulated. The cooked fish may be removed from the boiler and placed in a press with the aid of a ladle covered with wire mesh. Small wine presses are suitable for pressing the fish or a simple screw press may be constructed from wood for the purpose. Best results will be obtained if the cooked material is pressed between cloths. A presscake with as low as 35% moisture may be obtained in this way.

Two small mechanized installations are available for processing as little as 2 tons of raw fish per day. The first of these is a direct dryer for non-fatty fish. Fish to be dried are first macerated in a disintegrator and then passed through a flame dryer consisting of a steel cylinder mounted on trunnions. Longitudinal flights inside of the rotating cylinder lift the fish particles and allow them to be intermingled with the hot gases passing through the dryer concurrently with the meal. In direct drying with recirculation the disintegrated raw material is mixed with dried or semi-dried material so that the mixture forms a product that can be dried without difficulty from sticking, caking, or lumping. All that is needed in addition to the flame dryer is an efficient blending device.

The second type of installation is an indirect cooker and dryer that is most suitable for fatty fish. The cooker and dryer each consist of a steel cylinder mounted on trunnions and containing a series of horizontal iron tubes which rotate in the charge of presscake. The transfer of heat is from the flue gases through the metal tubes to the fish. Fatty fish is usually pressed for the removal of oil and water after cooking and before drying.

4.64 EFFECTS OF ANTIOXIDANTS ON THE THERMAL DECOMPOSITION OF FAT PEROXIDES IN VACUO

Privett, O. S. and Quackenbush, F. W.
Journal of the American Oil Chemists' Society 31, No. 7, 281-283 (July, 1954)

1. The antioxidants, α-tocopherol, NDGA and hydroquinone, effected a marked acceleration on the in vacuo, thermal decomposition of fat peroxides. Their action, which appeared to be purely catalytic, increased progressively as their concentration was increased.

2. The synergists, citric and ascorbic acids, exerted no influence on the rate of decomposition of the fat peroxides. However these agents suppressed the catalytic effect of the antioxidants to varying degrees. Both citric and ascorbic acids exerted their greatest influence at relatively low levels.

3. The evidence lends support to the concept that the peroxide radical is the point of intervention by the antioxidant in the chain reaction of autoxidation.

Authors' summary

4.64 NEW LARD ANTIOXIDANT, BHT, WORKS WELL IN COMBINATION WITH BHA

Anonymous
National Provisioner 130, No. 24, 22 (June 12, 1954)

Detailed information has recently been released regarding the antioxidant value of butylated hydroxytoluene (BHT) when used in lard and other animal fats and regarding the carrythrough protection afforded to foods and feeds in which BHT-treated fats have been used.

Test data show that, when added to lard at the 0.01 percent level now approved for food use, BHT's stabilizing effect on lard is essentially similar to that of BHA but that BHT's carrythrough effect is less than that of BHA. Especially significant, however, is the discovery that BHT and BHA are effectively synergistic and that, when used in the permitted combination of 0.01 percent each in lard, a stability results that is in excess of that provided by a sum of the equivalent amount of each antioxidant used alone. Used together at 0.01 percent, a stability is provided that is some 38 hours greater than that provided by BHA at 0.02 percent and 47 1/2 hours greater than that provided by BHT at 0.02 percent.

An odd characteristic of BHT is that, while it synergizes with BHA, it does not synergize with propyl gallate. A disadvantage encountered in the use of propyl gallate or combinations of antioxidants containing propyl gallate is avoided in the BHT and BHA combination. Propyl gallate reacts with iron contamination and, where traces of iron are present in lard, propyl gallate in the antioxidant is likely to form blue-black sludges beneath some lards and bluish colors in other lards and shortenings.

Toxicity and pilot-plant tests indicate that BHT is safe for use at levels considerably greater than those that are approved for use in edible fats and foods.

ABSTRACTER: Roy C. Stevens

2.118 FIVE MODERN FLOATING FISH FREEZING PLANTS

Kramhoft, O. and Schott, E.
Modern Refrigeration 57, No. 674, 188-189 (May, 1954)

Twenty years ago a Danish company supplied Soviet Russia with two floating fish freezing plants using CO_2 refrigerating machinery on the Ottesen principle, having a salt solution into which the fish were submerged before freezing. The capacity was 50 tons per 24 hours.

In June 1952, the first of five additional ships having the same daily freezing capacity was delivered. However, these were to operate with air freezing and direct expansion of ammonia in the freezing coils. The cargo holds were to be refrigerated by an ammonia and brine plant.

It was specified by the owners that 50 tons of round salmon, cod, or flounders must be frozen daily in waters of 20°C. and with an outside air temperature of 30°C. The temperature at the center of the fish after immersion in fresh water for glazing was not to exceed -15°C. The equipment was to be capable of maintaining the cargo hold at -18°C., the working room at -5°C., and to hold the frozen fish at -15°C. to -18°C.

Because the space set aside for the refrigerating machinery was limited, the company had to design a new type of two-stage compressor with a large low pressure cylinder and a smaller high pressure cylinder; to reduce the length of the machine, the compressor crankshaft was provided with spherical roller bearings. To reduce the weight of the moving parts, the low pressure piston was made of ductile cast iron.

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ABSTRACTER: Roy C. Stevens

0.31 SQUALENE, A PRECURSOR OF CHOLESTEROL

Anonymous
Nutrition Reviews 12, No. 6, 174-175 (June, 1954)

Cholesterol can be synthesized in the body from acetate as the raw material. This synthesis is influenced by a number of metabolic conditions. H. J. Channon and G. R. Tristram (1937) have reported that the feeding of squalene to rats causes an increase in the cholesterol content of the liver. Squalene, an unsaturated hydrocarbon of the formula $C_{30}H_{50}$ forms a large proportion of the liver oil of certain fishes of the subclass Elasmobranchii. Squalene also occurs in yeast. It has been synthesized and found to be made up of 6 isoprene residues and to contain 6 isolated double bonds.

G. M. Tomkins, W. G. Dauben, H. Sheppard, and I. L. Chaikoff (1953) studied the conversion of acetate-C^{14} into cholesterol in liver slices prepared from rats receiving a diet containing 1 percent squalene. These liver slices showed a marked depression in their incorporation of C^{14} into cholesterol but not in the incorporation of C^{14} into carbon dioxide. As a result of these findings, Dauben and H. L. Bradlow (1952) synthesized C^{14}-labeled squalene which they administered to rats and incubated with liver slices. Incorporation into cholesterol could not be detected either in vivo or in vitro. R. G. Langdon and K. Bloch (1952) reported that the C^{14} of biologically prepared C^{14}-squalene (prepared from the nonsaponifiable fraction of the liver fat of rats fed C^{14}-carboxyl acetate) was incorporated into cholesterol in vivo.

An explanation of this apparent contradiction was obtained by observing that the infrared spectrums of the natural and synthetic compounds differed due to differences in the types of carbon-carbon double bonds of the natural and the synthetic squalene. Natural squalene is a homogeneous compound containing only trisubstituted ethylene bonds, whereas synthetic squalene is similar to "regenerated"

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ABSTRACTER: Martin Heerdt

2.118 (Cross Reference: 3.231)

Two of the above compressors, each with a capacity of about 550,000 B.T.U. per hour at an evaporating temperature of -37.5°C., direct coupled to 175-h.p. electric motors variable in speed between 350 and 260 r.p.m. are installed in the fish freezing plant. The cargo holds are cooled by another compressor of the same type with a capacity of 415,000 B.t.u. per hour at an evaporating temperature of -30°C. This is powered by a 90-h.p. electric motor.

The fish are taken aboard from trawlers by means of the ship's derrick and placed in the fish bins on the upper deck. After they have been machine-washed, the fish are slid down into the cool working room and packed into aluminum trays each holding about 40 pounds. The trays are then loaded in freezing baskets which are taken mechanically through the freezing tunnels where the fish are frozen in a cold air current of about -30°C. After freezing, the fish are melted from the trays by dipping them in glazing tanks, and a layer of ice is built up around them before they are packed in wooden boxes and transferred to the cargo hold.

0.31

squalene (squalene which has been passed through solid hexachloride). Both contain as much as 40% of unsymmetrically disubstituted carbon-carbon bonds. To check the hypothesis that the biosynthesis of cholesterol from squalene is a very stereospecific reaction, possible from natural squalene but impossible from either the regenerated or the synthetic form, Tomkins, Dauben, Sheppard, and Chaikoff fed one group of rats a stock diet containing natural squalene and another group of rats a diet containing regenerated squalene for a period of 9 days. The animals were then killed and their livers were excised, and portions were incubated with carboxyl-labeled acetate. From 1.5% to 2.6% of the C^{14} was recovered as cholesterol from rats receiving regenerated squalene. A diet containing 3% natural squalene brought about a pronounced reduction of the recovery of the added acetate C^{14} in the form of cholesterol. Recoveries of $C^{14}O_2$ and fatty-acid C^{14} were not affected by the ingestion of either type of squalene. The stereo-specificity of the reaction is confirmed by the fact that re-generated squalene does not interfere with the incorporation of labeled acetate into cholesterol. This agrees with the hypothesis that squalene dilutes a metabolic pool of a precursor of cholesterol. The theory is confirmed by unaffected recoveries of $C^{14}O_2$ and fatty-acid C^{14}. Squalene is probably an intermediary in the biosynthesis of cholesterol.

2.3 CUTTING OF FISH STICKS IMPORTANT OPERATION

Anonymous
Fishing Gazette 71, No. 6, 45 (June, 1954)

The cutting operation is of great importance in the production of fish sticks. Every operation that follows is largely dependent on the accuracy with which the cutter has done its work. Speed and dependability are essential.

The size and shape of the sticks, which are cut from frozen blocks, varies with the different processors. But, whatever the shape, the stick dimensions must be held to very close tolerances in order to go smoothly through the dipping, crumbing and frying operations and to fit the carton into which the sticks must be packed at the end of the line.

Experience has shown that iron and steel parts cannot be used in power cutting machinery because of their tendency to rust and corrode. Only stainless steel will stand up indefinitely under the extreme heavy duty of frozen fish stick cutting. Blades of even the finest tempered steel are worn down quickly, and a supply of perfect blades must be kept on hand ready for instant replacement.

Tests have shown that ordinary power meat cutters are not adequate for the fish stick cutting job. Special design, ample power, rugged durability, ease of disassembling for frequent complete cleaning, absolutely non-corrosive materials and finishes, and specialized blades or saws are necessary for frozen fish stick cutting. All electrical parts must be completely enclosed in a water-tight housing. The unit must be able to operate 24 hours a day, if necessary, without failure.

 ABSTRACTER: Roy C. Stevens

3.239 DENATURATION OF MYOSIN DURING DEFROSTING OF FROZEN FISH

Nikkila, Olavi E. and Linko, Reino R. (Central Laboratory of Tukkukauppojen Oy, Turku, Finland)
Food Research, 19, No. 2, 200-205, (March-April, 1954)

Freezing and subsequent storage may cause undesirable changes in fish. These changes, which make fish less palatable, vary according to the species, freshness, treatment prior to freezing, freezing method used, and the storage conditions. One of these forms of deterioration is concerned primarily with an irreversible change in the protein fraction of frozen fish. This change seems to be caused by a denaturation of the proteins and results in a drier and coarser muscle texture. Denaturated proteins lose their ability to swell, retain muscle juice, and to return to their original condition after defrosting.

Soluble proteins from fillets of Baltic herring (Clupea harengus var. membranus) were extracted at 0° C. with a 5% NaCl solution. The herring had been packed in wax cartons or in pliofilm bags, frozen in moving air at -35° C., stored at -20° C., and allowed to defrost under various experimental conditions. The myosin present in the soluble proteins extracted was precipitated by a 10-fold dilution with distilled water at 0-5° C. After 15 hours at 5° C. the myosin was centrifuged off and myosin nitrogen was determined by the micro-Kjeldahl modification (A. O. A. C.). Total nitrogen and soluble nitrogen were estimated by the Kjeldahl-Gunning-Arnold method as was non-protein nitrogen after precipitation of the protein from a 5% trichloracetic acid solution. Non-myosin nitrogen was obtained by difference.

The extraction of myosin with salt solution depends to a large extent upon the condition of the

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 ABSTRACTER: Martin Heerdt

3.19 ELECTRONIC STERILIZATION OF FOODS

Hannah, R. S.
Research 6, 376-383 (1953)
Food Science Abstracts 26, No. 3, 338 (May, 1954)

A summary of the main features that have emerged so far in work on the electronic sterilization of foods. The radiations used (high voltage cathode rays and γ-rays from radioactive materials) have the property of ionizing certain molecules of the bacterial cells, and thereby destroying their power to reproduce. The logarithm of the number of surviving bacteria decreases linearly with increasing dose of radiation, but the sterilization dose for a given product depends partly on the treatment it has received and on other factors. The doses that destroy higher animals, insects and their eggs, bacteria, yeasts and moulds, bacterial spores, and viruses, are, respectively, of the order of 1,000, 100,000, 500,000, 1,000,000, 2,000,000, and 5,000,000 rep (roentgen equivalent physical). Cathode rays have the disadvantage that only thin layers of material can be sterilized; γ-rays, produced by waste products from atomic energy projects, require complicated protective measures for workers. Both tend to cause unpleasant flavours and odours, and changes of colour and texture, in foods. Irradiation at very low temperature in the absence of oxygen minimizes these effects. The irradiation of meat, fish, dairy products, and fruits and vegetables is discussed. The cost of the process is likely to be high, and it will probably be used first for pharmaceutical and medical purposes.

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3.5 BROWNISH-YELLOW DISCOLORATION OF SALT COD AND HALOPHILE CALCIUM-NEEDING MICRO-ORGANISMS

Olafsson, Pall (Chemical Laboratory, Icelandic State Herring-oil and Meal Factories, Siglufjordur, Iceland)
Nature, 173, No. 4415, 1143 (June 12, 1954)

The cod industry of Iceland has suffered heavy losses from a brownish-yellow discoloration of salt cod. This discoloration begins 10 to 20 days after salting. The flesh of the salt cod first becomes cream colored, then yellow, and finally turns brownish-yellow to brown in from 3 to 5 weeks after salting. This brownish-yellow discoloration in salt cod has also been observed in other countries such as Canada and Great Britain.

Dyer (1949) believed the brownish-yellow discoloration in salt cod to be caused by small amounts of iron in the fishery salts, whereas the report of the Food Investigation Board for 1951 suggested that the discoloration may be caused by the Maillard reaction.

The author concludes as a result of his studies that the discoloration is caused by calcium-deficient halophile microorganisms. His conclusions are based on the following results.

Skin-and-bone-free discolored salt cod was found to contain 0.28% calcium, whereas unspoiled salt cod was found to contain 0.16% (8 samples). In discolored salt cod the calcium content in excess of sulfate was 0.2%, whereas in unspoiled salt cod it was only 0.08%. The calcium content of the salt in experimental stacks of salt cod was reduced more than the sulfate content. Thus the

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 ABSTRACTER: Martin Heerdt

3.5

ratio of calcium to sulfate for one sample of salt cod prepared with contaminated salt increased from 0.46 to 1.38 over a period of 43 days in the stack. In another stack of salt cod with an excess of salt, the ratio increased from 0.37 to 0.46 in 17 days and to 0.54 in 36 days.

Discoloration did not occur in salting experiments in which the salt (3 samples) had been sterilized by heating for 4-1/2 hours at 150° - 180° F. Discoloration in salted cod could be increased by adding calcium chloride to the contaminated salts, but no increase in the amount of discoloration was apparent when magnesium sulfate was added to the contaminated salts.

Three samples of contaminated salts contained, respectively, only 0.04, 0.02, 0.00% calcium chloride. One of these samples of contaminated salt with a 0.05% calcium content caused discoloration only if calcium chloride was added to the salt prior to use.

The author concluded that the microorganisms in contaminated salt reduce the sulfate in the calcium sulfate impurities to obtain a soluble form of calcium.

2.3 (Cross Reference: 3.230)

3.239

fish. During rigor mortis the amount of myosin (the fraction extracted by a salt solution and precipitated on dilution with water) present in the salt extract was very low, e. g., in one experiment only 27.6% of the total protein nitrogen was extracted during rigor, whereas 68.0% was extracted after the resolution of rigor. The changes that take place in the proteins during rigor are reversible. Chilling, freezing, and cold storage prolong but do not inhibit the final resolution of rigor. The myosin extractable from muscle that had been frozen in rigor increased after the muscle had been in storage for a few days at -20° C. Other observations, however, have indicated that the myosin of muscle frozen in rigor and subjected to cold storage is more likely to become denatured during defrosting than is that of muscle frozen after the resolution of rigor.

Storage of fresh herring at room temperature increased the amount of brine-extractable myosin, whereas the storage of frozen herring at room temperature caused a small loss in myosin extractability in the beginning and a very large loss after the herring had been defrosted. It appears, therefore, that freezing causes a change in the condition of the native proteins and makes them more liable to denaturation. Defrosting in air at 18° C. for about 7 hours (incomplete defrosting) caused no marked loss in myosin solubility. However, with continued storage the myosin was denatured rapidly and to a marked degree. If the storage time and defrosting temperature were increased, the myosin became increasingly less soluble in salt solution. Refreezing altered the state of the myosin molecules in such a way that denaturation was increased during defrosting and subsequent storage. This type of denaturation is irreversible, in contrast to the reversible alteration of proteins in rigor. Some experimental observations indicate that the denaturation of fish proteins during freezing and cold storage may differ from the denaturation that takes place during defrosting and subsequent storage.

1.015 FISH OF THE FIELD

Anonymous
Canadian Fisherman 41, No. 7, 24 (July, 1954)

The Malayan Government's Fisheries Department is carrying out experiments with various species of fish in an effort to provide rice farmers with an economical source of protein. Most promising so far is "telapya", a hardy and easy to breed vegetable-eating fish. Five varieties of grass-eating carp are also on the Department's experimental list to which have been added five kinds of carp from India and two from Indonesia.

The argument presented to a farmer in soliciting his cooperation is that although a moat around his padi plot may reduce his rice crop by 500 lbs., it will gain him 500 lbs. of protein from fish.

The Fisheries Department is also collaborating with private individuals in other types of fish-raising enterprises. An example is the pig-farm fishpond Agricultural Syndicate at Bayan Lepas, Penang. Here 300 pigs, in a long, grass-thatched sty at the edge of a 10-acre site, fertilize 20 ponds through a maze of irrigation ditches. The manure causes the rich and rapid growth of a leafy water-cress on which the pigs and the fish -- 4,000 to 5,000 in each of most of the 20 ponds -- feed. The manure also attracts insects and larvae to provide for the fishes' vegetarian diet; and finally, when the ponds get their annual dredging, the detritus is piled into bunds on which profitable fruit trees are grown. Pork marketing from the pig breeding produces a third means of income in addition to the fish and fruit.

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COMMERCIAL FISHERIES ABSTRACTS VOL. VII NO. 10 PAGE 13
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. ABSTRACTER: Roy C. Stevens

2.00 CHEMICAL PREVENTION OF BLACK SPOT (MELANOGENESIS) IN ICED STORED SHRIMP

Bailey, Milton E. and Fieger, E. A. (Louisiana State University, Baton Rouge, Louisiana)
Food Technology 8, No. 7, 317-319 (July, 1954)

The black bands and areas known as black spot that develop on shrimp are caused by the autoxidation of certain chromogens of the phenol-amine type which are probably formed from the breakdown of shrimp protein. Shrimp containing black spots are frequently called melanotic shrimp. Large quantities of shrimp presently appearing on the market have developed this black discoloration during the two weeks that the shrimp boats remain on the fishing grounds before returning to sell their catch.

The authors determined the value of certain practical chemical inhibitors of black spot (melanin) formation in common Gulf shrimp (Peneaus setiferus). They also attempted to determine the quantity of sulfite retained by shrimp that had been stored for five days in 0.25% sodium bisulfite ice.

A slight amount of protection from black spot formation over a period of 8 days in ice was obtained by soaking the shrimp for 5 minutes in 1% sodium sulfite solution or for 10 minutes in 1% ascorbic-citric acid solution before packing them in ice. The ascorbic -citric solution was made by dissolving 1 part by weight of an 8% ascorbic and 92% citric acid mixture in 100 parts by weight of water. Shrimp soaked for 10 minutes in ascorbic acid solutions containing 1/2 of 1% ascorbic acid before packaging in ice were protected from black spot formation for about 4 days. Dilute ascorbic acid solutions or ascorbic-citric acid (8-92) solutions maintained the natural color and odor of shrimp

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COMMERCIAL FISHERIES ABSTRACTS VOL. VII NO. 10 PAGE 13
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. ABSTRACTER: Martin Heerdt

2.12 GULF-OF-MAINE BLUEFIN TUNA EXPLORATION -- 1953

Murray, J. J.
Commercial Fisheries Review 16, No. 7, 10-19 (July, 1954)

The third successive season of exploratory fishing for Gulf-of-Maine bluefin tuna was conducted from July 15 to October 15, 1953. As in the previous year's work, long-line gear was used as the principal fishing method, with surface trolling lines, floating gill nets, and trammel nets as secondary gear. The long-line catch of tuna was much smaller than in the preceding years -- only 38 tuna weighing 2,000 pounds (round weight) as compared to 12,000 pounds in 1952, and 190,000 pounds caught by purse seine in the 1951 exploration. One reason for the small catch was that the start of the project was delayed until July 15 and a large early run of tuna was completely missed. Also, the catch of sharks was much greater, being 13 times the catch of tuna. Gill-net and trammel-net fishing produced no tuna. Nine tuna were caught on the surface trolling lines. Though catches were small, bluefin tuna were taken over a wide area in the Gulf of Maine and adjacent waters as in the previous years.

An encouraging development noted in the 1951-53 seasons was the catching of sizable quantities of tuna by the New England otter-trawl fleet, incidental to trawling operations. The crews of many of these vessels found that tuna schools, attracted to the vessels by small fish which escaped or were discarded from the trawls, would at times bite readily on improvised hand lines baited with herring, mackerel, or squid. Catch records show that 140,000 pounds of tuna caught by this method were landed at Boston and Gloucester in September and October 1951. Reported production from hand-line catches in 1953 amounted to 146,000 pounds. This development indicates that a hook-and-line fishery, somewhat similar to the method used by Pacific tuna clippers, might be successfully applied to the New England tuna fishery.

COMMERCIAL FISHERIES ABSTRACTS VOL. VII NO. 10 PAGE 13
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. Author's summary

2.2 CANADIAN FILLET AND PACKAGING PLANT

Anonymous
Fishing Gazette 71, No. 6, 42 C-45 (June,1954)

This new, modern plant is located near Cape Breton Island, Nova Scotia, and close to the abundant fishing grounds of the North Atlantic. Millions of pounds of haddock and cod are taken from traps and trawls within as close as 500 yards from the plant's pier and with much of the production within a very few hours' run of the plant.

Unloading facilities are provided to handle one trawler, two 60-foot draggers, and 12 smaller shore boats at the unloading pier. Facilities are provided for storing up to 300,000 pounds of iced whole fish. The fish are dumped into hoppers and flow with chilled sea water into the plant.

All operations are performed in a single line, and all equipment is of stainless steel. Fillets are cut at a cutting table provided with 30 stations for filleters. The fillets are carried in a trough by chilled brine over a candling table and then on a stainless steel belt to the weighing hopper. They are then packaged and sent on to be overwrapped or placed in pans and frozen in plate freezers. After freezing, the packages are stored at -18°F. Only 35 minutes elapse from the time the whole fish are placed in the hopper until the fillets enter the freezer.

Fillet inspection is carried out for appearance of fillets, cleanliness of fillets, texture of flesh, evidence of trimmings and blood spots, odors, and presence of skin and bones.

The processing room is provided with special sanitary features. Hose outlets for hot water are located every 15 feet for washing down the line. Hypochlorinator units provide chlorinated water.

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COMMERCIAL FISHERIES ABSTRACTS VOL. VII NO. 10 PAGE 13
UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE. ABSTRACTER: Maurice E. Stansby

2.12 (Cross Reference: 1.1)

2.2

Glare-free illumination is furnished by overhead fluorescent lighting.

Fish waste from the fillet line flows underground with water to a holding room adjacent to the reduction plant, which is housed in a separate building. Fish meal processing equipment is of German manufacture. The waste is ground in a hogger, cooked in steam cookers, and dried in three steam-jacketed driers. Capacity of the fish meal plant is 5 tons per day. "Whole" meal is prepared by adding concentrated stickwater to the meal. Fish oil is recovered through settling tanks.

A controlled smokehouse with a capacity of 12,000 pounds per day of smoked kippers, finnan haddies, or cod fillets is installed in a section partitioned off from the main processing room.

1.015 (Cross Reference: 9.16)

The fish are marketed in distant parts of the Federation and even exported by a system in which the fish are placed in four-gallon kerosene cans filled with water and then sealed after half the water has been blown out by oxygen. The fish are then shipped by air-freight.

Malaya's fresh-water fish production program has become so advanced and successful that requests for information have been received from many parts of the world.

2.00 (Cross Reference: 1.85)

for about 9 days.

Ices containing sodium bisulfite, sodium sulfite, or sodium chloride were also used as a packing medium for shrimp. Shrimp packed in ice containing 0.25% sodium bisulfite or in ice containing 0.25% sodium sulfite received between 92 and 97% protection against melanin formation over a period of 14 days. These shrimp also retained their natural color and odor throughout the first 12 days of storage in sulfite-containing ices. Shrimp packed in 0.25% sodium chloride ice received about 92% protection against melanin formation.

The average concentration of sulfite (SO_3^{--}) in unwashed and uncooked shrimp that had been stored for 14 days in 0.25% sodium bisulfite ice was 117.3 mg./100 grams of shrimp. Washing and boiling for 8 minutes in 1% sodium chloride reduced the SO_3^{--} content to 50.6 mg./100 grams of shrimp.

3.5 A NOTE ON THE CONTROL OF DUN

Vaisey, E. B.
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations, No. 58, 32 (April, 1954)

In spite of the fact that the fungus causing dun requires large concentrations of common salt for growth, experiments in this laboratory have shown that otherwise it behaves much as other food-contaminating fungi. For instance its spores were still capable of germinating after being immersed in tap-water and soil for periods greater than three weeks. They were also resistant to freezing at 17° F. and survived desiccation at room temperature for periods greater than one month. The hardiness of the organism suggests that dun is likely to persist until the salt fish industry can be housed in easily cleaned buildings of concrete or tile.

As the latter is unlikely to happen in the near future, the most feasible method of control would be to treat fish that is likely to develop dun with some chemical which would prevent the fungus from growing. At the present time, the Food and Drugs Act, for the protection of the consumer, permits application of only the following on salt fish: sugar, potassium and sodium nitrate, wood smoke, vinegar, spices, and alcohol. These have been found to be either ineffective or incompatible with the desired characterisitcs of the product. However, with certain other foods, other compounds may be added; of these only sorbic acid or propionic acid or its salts would appear to be of value in controlling dun.

When compared in the laboratory, it was found that sorbic acid was much more effective than sodium propionate in preventing the growth of dun. Moreover, it is particularly well suited as a preservative for salt fish as its taste, colour, and odour cannot be detected when applied in fungicidal

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 Reprinted in whole

2.08 TRANSPORTING SHRIMPS IN BRITISH COLUMBIA

Anonymous
Canadian Fisherman 41, No. 7, 22 (July, 1954)

A tank of sea water mechanically refrigerated to about 29.5° F. for holding dressed, freshly-caught salmon on board a commercial fishing boat was described in a previous abstract (Commercial Fisheries Abstracts VI, No. 12, 3, December, 1953). The present article presents the engineering data for experimental equipment of similar design installed on a British Columbia fishing vessel and describes the results of experiments conducted with shrimp.

The first of two loads of raw whole shrimp brought to Vancouver from the fishing grounds with this equipment consisted of 100 pounds that had been held for eight days at a temperature of 30 ± 1° F. These shrimp were judged acceptable on arrival. A portion of this catch, frozen green, heads off, in water, were judged acceptable after a week's storage by a commercial shrimp operator.

A 600-pound load of shrimp was later brought to Vancouver after 4 days holding. This load had been placed in a tank of sea water at a temperature of 41° F. and cooled to 30 ± 1° F. The commercial operators to whom samples of this load were distributed judged the shrimp to be of good quality but stated that they were difficult to pick.

In an attempt to overcome this difficulty of picking, further holding tests were conducted at the Pacific Fisheries Experimental Station. Shrimp less than 24 hours old, obtained from commercial fishermen, were held at 20° F. for periods up to nine days in sodium chloride brines somewhat saltier than sea water. Preliminary results indicated that the chilled stronger brines containing up to 6 percent salt, give the fisherman a better quality, more easily picked product than does chilled sea water at the same temperature.

 ABSTRACTER: Roy C. Stevens

2.113 BARNACLE BILL--LOWER?

Judah, Melvin A.
Industrial and Engineering Chemistry, 46, No. 7, 11A, 13A, (July, 1954)

According to theory, the efficiency of copper antifouling compounds depends upon their ability to dissolve and yield cuprous ions. Cupric hydroxide has been judged ineffective as an antifouling compound because of its lower solubility in sea water as compared with the solubility of the conventionally-used cuprous oxide.

However, a simple method for preparing a cupric hydroxide pigment that has shown good antifouling properties in marine paint tests has recently been patented. According to the data, less cupric hydroxide is required to reach the point of adequate protection against fouling than is required with cuprous oxide. Cupric hydroxide also contains less copper than cuprous oxide. The net result is equal antifouling protection with as little as one-sixth the amount of copper when using cupric hydroxide paints.

Cuprous oxide paints applied to test panels immersed in sea water at Miami, Florida, began to break down after only eight months, at which stage fouling covered 25 to 90 percent of the panel surface; whereas cupric hydroxide paints tested under similar conditions were only slightly blistered after one year, at which stage fouling covered only 10 to 20 percent of the panel surface. On test panels immersed for 14 months in sea water at Atlantic City, N. J., paints containing 1.9 pounds of cupric hydroxide per gallon were effective in confining fouling to less than 25% of the panel surface. A second type of paint formulation containing one pound of cupric hydroxide per gallon prevented fouling for 12 months. Comparison paints containing cuprous oxide at the rate of 1.25 pounds per gallon permitted fouling to the extent of 65% of the panel area after only 5 months of immersed

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 ABSTRACTER: Martin Heerdt

3.249 FREEZING AND COLD STORAGE OF PACIFIC NORTHWEST FISH AND SHELLFISH. PART III - STORAGE CHARACTERISTICS OF SIX SPECIES OF OILY FISH

Heerdt, M. and Stansby, M. E.
Commercial Fisheries Review 16, No. 6, 1-5 (June, 1954)

The following were the species studied: pilchard (Sardinops caerulea), eulachon (Thaleichthys pacificus), albacore tuna (Germo alalunga), sablefish (Anoplopoma fimbria), herring (Clupea pallasii), and silver smelt (Hypomesus pretiosus). In the preparation of the samples for storage, the fish were dressed and cut into pieces of appropriate size. Two series of samples were then packaged, a test series and a control series. The temperature at which all of the samples were stored ranged from 6° to 16° F.

The test samples of pilchard, eulachon, herring, and silver smelt were prepared by carefully laying the fish side by side, two layers deep, into rectangular aluminum pans until each contained about 5 pounds of fish. Once filled, each pan was covered with a tight-fitting lid and subjected to rapidly moving air at -20° F. for about 2 1/2 hours, during which time the fish froze into a unit mass or block conforming to the shape of the pan. The pans were then immersed in water at 32° F. As each block thawed slightly, came free from the pan, and was lifted from it, the water adhering to the block froze into a protective glaze covering all of the surface. These glazed blocks were loosely packed into fiberboard cases for storage. Each sample of tuna and sablefish was wrapped tightly in a single sheet of MAST cellophane. The wrapped samples were packed into rectangular aluminum pans, each of which had a capacity of 5 pounds. After the pans were covered with tightly fitting aluminum lids, they were held for at least 2 1/2 hours at -20° F. in a stream of rapidly moving air. The samples, which were hard frozen, were then transferred from the pans to five-pound, two-piece, folding waxed cartons.

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 ABSTRACTER: Martin Heerdt

CONTROL OF DUN IN SALT FISH

ANTIFOULING PAINT

CHILLED SEA-WATER TRANSPORTATION OF SHRIMP

STORAGE CHARACTERISTICS OF OILY FISH

2.113

exposure to sea water, and 4.3 pounds of cuprous oxide per gallon of paint was required to completely prevent fouling for a total of 14 months.

The copper content of the air-dried cupric hydroxide pigment material is about 58 percent. A high degree of purity and the removal of all moisture is not required for its use as an antifouling paint pigment material. Absorption approximates 60% when the pigment is mixed with the vehicle. This is not a problem because of the small amount of cupric hydroxide used per gallon of paint.

Studies begun in 1952 to evaluate cupric hydroxide as a pigment are now being conducted under commercial sponsorship. There are indications that cupric hydroxide acts on the attachment contact surface of the fouling organism and not by supplying a solution of copper leaching or flowing out from the paint.

3.249 (Cross References: 1.1, 1.2, 1.5)

The control samples were packed in 1/2-pound flat cans in one of three ways as follows: (1) the 1 5/8-inch lengths of herring, pilchard, and tuna were packed tightly on end; (2) the sablefish steaks were packed flat, two deep; and (3) the eulachon and silver smelt were packed curled into circles. The cans were then sealed under 15 inches of vacuum, held for 2 1/2 hours in rapidly moving air at -20° F. to hard freeze their contents, and finally transferred to open wooden boxes, which were placed in frozen storage.

The samples were prepared for organoleptic examination by a test panel after 0, 90, 180, and 270 days of storage. In each test this panel was made up of at least eight people experienced in making organoleptic determination. About 5 pounds (one block) of the ice-glazed or cellophane-wrapped fish and 8 to 10 cans of the vacuum-packed controls were examined at each interval. All samples were thawed at room temperature in moving air from an electric fan. Both the thawed test samples and the thawed control samples were immersed in a six-percent salt solution for five minutes to bring out the natural flavor of the fish. Upon being removed from the solution, the samples were drained, baked for 20 minutes on cooky sheets in an oven set at 350° F., and then immediately served to the test panel. After observing color changes, if any, and noting the odor, flavor, and texture of the sample, each panel member assigned to the test sample and to the control sample one of the following ratings: VG for very good (highest quality), G for good (some loss of original quality but no indication of rancidity), F for fair (slightly rancid), and P for poor (rancid and barely edible), and U for unacceptable (very rancid). The results of the organoleptic examinations appear in table 1, below.

Table 1--Effect of Time in Frozen Storage on the Quality of Six Species of Commercially-Packaged Oil Fish Taken in the Coastal Marine Waters of the Pacific Northwest

Time in frozen storage at 0° to 10° F.	Quality Rating1/											
	Pilchard		Eulachon		Albacore tuna		Sablefish		Herring		Silver smelt	
	Ice-glazed block	Control in tin	Ice-glazed block	Control in tin	Cellophane wrapped	Control in tin	Cellophane wrapped	Control in tin	Ice-glazed block	Control in tin	Ice-glazed block	Control in tin
Days												
0	G	G	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG
90	P	F	F	F	F	VG	G	VG	G	VG	G	VG
180	P	F	F	F	F	VG	F	G	G	G	G	VG
270	P	F	P	P	F	VG	F	G	F	G	F	F

1/VG = Very good (highest quality)
G = Good (some loss in original quality but no indication of rancidity)
F = Fair (slightly rancid)
P = Poor (rancid and barely edible)
U = Unacceptable (very rancid)

3.5

amounts. Arrangements are now underway to test sorbic acid under commercial conditions. The results of these tests will appear in a subsequent report.

2.08 (Cross References: 1.85, 2.19)

2.01 STUDIES OF FISH SPOILAGE. VI. THE BREAKDOWN OF CARBOHYDRATES, PROTEINS, AND AMINO ACIDS DURING SPOILAGE OF COD MUSCLE PRESS JUICE

Beatty, S. A. and Collins, V. K.
Journal of the Fisheries Research Board of Canada 4, No. 5, 412-423 (February, 1940)

Cod muscle press juice was allowed to spoil in the presence and absence of toluene, both anaerobically and aerobically. The juice was incubated in 30-ml. quantities either in closed test tubes or in loosely stoppered 500-ml. Erlenmeyer flasks. Storage tests were conducted at 0.5° C., 5° C., and 25° C. At intervals, trimethylamine, lactic acid, carbon dioxide, sugar, amino acids, and ammonia were determined.

The presence of toluene is believed to inhibit the growth of most bacteria and to have little effect on enzymatic autolysis. In the presence of toluene, change in formation or decrease in all the constituents determined was considerably retarded. Presence of air had little effect on trimethylamine formation or on disappearance of sugar. Lactic acid decreased more rapidly in the presence of air, and carbon dioxide, amino acids, and ammonia all increased more rapidly when air was present.

The authors conclude that changes in the press juice occur in three stages. An early post-mortem change, which does not involve bacterial action, includes breakdown of glycogen and phosphocreatine and the formation of traumatic ammonia. The lactic acid, formed in this first stage, is oxidized along with any sugars present in the second stage. The final stage, representing advanced spoilage, occurs after the second stage is well under way. This third stage involves the oxidation of amino acids and the hydrolysis of proteins.

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 ABSTRACTER: M. E. Stansby

2.01 THE BACTERIAL REDUCTION OF TRIMETHYLAMINE OXIDE TO TRIMETHYLAMINE

Tarr, H. L. A.
Journal of the Fisheries Research Board of Canada 4, No. 5, 367-77 (February, 1940)

Thirty different microorganisms were isolated from spoiling halibut and allowed to act upon sterile aqueous extracts of fresh halibut muscle for 4 days at 25° C. in open tubes. In another series of experiments, washed suspensions of cells of the organisms were prepared and incubated 16 hours at 25° C. in Thunberg tubes anaerobically (a) alone, (b) with halibut muscle extract, and (c) with M/50 trimethylamine oxide. After incubation, trimethylamine was measured in each case.

Only three of the thirty microorganisms produced trimethylamine under these conditions. Two of these were of the Micrococcus genus and one of the Achromobacter genus. Twelve other Micrococcus samples and 5 other Achromobacter samples did not produce trimethylamine, nor did other yeast samples nor any Flavobacterium samples.

Tests were next carried out to determine the effect of the addition of several dehydrogenase systems present in bacterial cells on reduction of trimethylamine oxide. All systems studied, which included such oxidizable substrates as lactate, succinate, acetate, formate, and glucose solutions, were able to reduce the trimethylamine oxide to trimethylamine. These and other experiments indicated that the bacterial reduction of trimethylamine oxide is due to the presence in the cells of the bacteria of an enzyme capable of activating the molecule and rendering it susceptible to reduction by various dehydrogenase systems.

 ABSTRACTER: M. E. Stansby

7.82 THE MEASUREMENT OF SPOILAGE IN FISH

Beatty, S. A. and Gibbons, N. E. (Atlantic Fisheries Experimental Station, Halifax, N. S.)
Journal of the Biological Board of Canada 3, No. 1, 77-91 (November-December, 1936)

This 1936 report contains the first proposal that trimethylamine be used as an index of freshness of fish.

The procedure developed is based on the microdiffusion technic of Conway and Byrne, and this necessitates use of press juice rather than solid fish tissue. The press juice is obtained in a brass press cup perforated with 1/16-inch holes and lined with Whatman No. 1 filter paper.

Standard acid (usually about 1/70 N) is placed in the inner ring of the Conway dish and 1 ml. press juice and 0.5 ml. formaldehyde solution in the outer ring. After the solutions are mixed by rotating the dish, 1 ml. saturated potassium carbonate is added from a fast-delivery pipet, the lid slid into position, the dish rotated to mix the contents, and the dish and contents then incubated for 2 hours at 36° C. The excess standard acid is then titrated using the mixed indicator methyl red-methylene blue to detect the end point. Speed of recovery of trimethylamine after different incubation periods at 36° C. is shown in Table 1, this card, over.

The lowest value found on individual fresh cod, haddock, herring, hake, and pollack was 0.06 mg. trimethylamine nitrogen per 100 ml. press juice. The maximum was 0.3 mg., with an average of 0.17 mg. Odors first appear at 4 mg. and are definite at 10 mg. Maximum values of 30 mg. or more occur in advanced stages of spoilage.

Data are presented to show that trimethylamine increases very little in the storage of sterile cod muscle. In another experiment, the rise in trimethylamine is shown graphically when non-sterile

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 ABSTRACTER: M. E. Stansby

3.12 CHEMICAL INHIBITION OF GROWTH OF FISH SPOILAGE BACTERIA

Tarr, H. L. A.
Journal of the Fisheries Research Board of Canada 6, No. 3, 257-66 (May, 1944)

Penicillic acid and 4-methoxy-2:5 toluquinone in 0.01 or 0.001 percent concentration inhibited growth of pure cultures of certain fish spoilage bacteria on laboratory media, their action being more pronounced in slightly acid than in neutral or faintly alkaline media. Neither compound in 0.01 percent concentration was effective in retarding bacterial spoilage of halibut muscle, and in 0.1 percent concentration retarded bacterial spoilage of coho salmon muscle only feebly.

Isolated cultures of fish spoilage bacteria on laboratory media were rapidly inactivated by treatment with methyl bromide, but treatment of fish muscle with different partial pressures of this gas under partial vacuum occasioned only a very minor reduction in its viable bacterial content.

Treatment of fish muscle with ethylene oxide, propylene oxide and methyl formate as gases under partial vacuum markedly delayed the increase of bacteria therein. When applied in solution, from 0.1 to 1.0 percent of these compounds was required in order to markedly delay bacterial growth in fish muscle. Ethyl formate appeared to be as active as methyl formate in preventing bacterial growth, but both compounds occasioned a very marked "coagulated" appearance in treated fish flesh.

Sodium nitrite (0.02 percent) retarded bacterial increase in fish flesh, but penicillic acid, 4-methoxy-2:5 toluquinone, sodium chlorite, sodium benzoate and a patent fish preservative studied were much less effective in this respect. None of a number of other compounds studied delayed bacterial growth appreciably in fish flesh.

 Author's summary

SPOILAGE OF COD MUSCLE PRESS JUICE

TRIMETHYLAMINE FRESHNESS TEST

TRIMETHYLAMINE OXIDE REDUCTION

FRESH FISH PRESERVATIVES

7.82

cod press juice is stored at 0.5°C., 10°C., and 25°C. Rapid rise in trimethylamine occurs in about 150 hours at 0.5°C., in 30 hours at 10°C., and in about 17 hours at 25°C.

Another section of the paper deals with total volatile base as a measure of freshness. Total volatile base can be used as an index only if the original value of the fish in question is known, because this original value varies over wide limits.

Table 1

Incubation time (min.)	Mg. N per 100 ml. press juice	
	Fresh	Partially Spoiled
30	0.04	0.95
	0.03	0.95
60	0.09	1.25
	0.11	1.29
90	0.15	1.43
	0.16	----
120	0.18	1.66
	0.17	1.65
	0.17	----
150	----	1.71
	----	1.65
	----	1.61
180	0.21	1.61
	0.21	1.63

3.12 (Cross Reference: 2.01)

2.01 (Cross References: 2.02, 2.03, 2.00)

During early spoilage most of the bacterial action is anaerobic. In advanced spoilage, if air is present, the bacterial growth is predominantly aerobic.

Trimethylamine production occurs mostly during the middle stage.

2.01 (Cross References: 7.86, 7.81)

1.1 FREEZING AND COLD STORAGE OF PACIFIC NORTHWEST FISH AND SHELLFISH. PART III - STORAGE CHARACTERISTICS OF SIX SPECIES OF OILY FISH

Heerdt, M. and Stansby, M. E.
Commercial Fisheries Review 16, No. 6, 1-5 (June, 1954)

(Abstract of this article appears under 3.249 page 15)

1.1 GULF-OF-MAINE BLUEFIN TUNA EXPLORATION -- 1953

Murray, J. J.
Commercial Fisheries Review 16, No. 7, 10-19 (July, 1954)

(Abstract of this article appears under 2.12 page 13)

1.1 NFI TOPICS: FISH STICKS, TUNA AND REEFER SHIPS

Anonymous
Food Engineering 26, No. 6, 235-36 (June, 1954)

(Abstract of this article appears under 9.2 page 3)

1.30 THE AMINO ACID CONTENT OF ROE AT DIFFERENT STAGES OF MATURITY FROM THE FIVE SPECIES OF PACIFIC SALMON

Seagran, Harry L.; Morey, David L.; and Dassow, John A.
Journal of Nutrition 53, No. 1, 139-149 (May, 1954)

(Abstract of this article appears under 8.51 page 3)

1.30 TREND TO MILDNESS SHIFTS SMOKERS TO FROZEN SALMON

Anonymous
Pacific Fisherman 52, No. 6, 57-59 (May, 1954)

(Abstract of this article appears under 3.4 page 15 - July, 1954 issue)

1.30 OFFSHORE SALMON EXPLORATIONS ADJACENT TO THE ALEUTIAN ISLANDS, JUNE-JULY 1953

Schaefers, Edward A. and Fukuhara, Francis M.
Commercial Fisheries Review 16, No. 5, 1-20 (May, 1954)

2.00 STUDIES OF FISH SPOILAGE. VI. THE BREAKDOWN OF CARBOHYDRATES, PROTEINS, AND AMINO ACIDS DURING SPOILAGE OF COD MUSCLE PRESS JUICE

Beatty, S. A. and Collins, V. K.
Journal of the Fisheries Research Board of Canada 4, No. 5, 412-423 (February, 1940)

(Abstract of this article appears under 2.01 page 17)

2.00 THE REACTIONS OF TRIMETHYLAMINE OXIDE AND UREA DURING STORAGE OF MARINE ELASMOBRANCHS AND TELEOSTS

Hjorth-Hansen, Sverre and Bakken, Kare
Fiskeridirektoratets Skrifter 2, No. 5, 3-13 (1952)
Chemical Abstracts 47, No. 14, 7118 (1953)

Storage expts. with muscles of porbeagle basking shark and salmon at temps. about 0° indicate that more urea and more trimethylamine oxide were split than could be estd. by analyses of NH_3 and $N(CH_3)_3$. The same phenomenon did not take place with muscles of cod, Greenland shark, skatewings, and dogfish.

2.00 CHEMICAL STUDIES ON THE FRESHNESS OF WHALE MEAT. II. COMPARISON OF THE DETERIORATION AND AUTOLYSIS IN WHALE MEAT AND BEEF

Nakai, Tadashi
J. Pharm. Soc. Japan 68, 172-4 (1948)
Chemical Abstracts 47, No. 16, 8280 (1953)

2.01 FRESH FISH. II. THE ROLE OF pH IN THE GROWTH OF BACTERIA

Nadeau, Par Aristide (Gaspe Fisheries Experimental Station, Grande Riviere, P. Q.)
Journal of the Fisheries Research Board of Canada 5, No. 2, 121-130 (November, 1940)(In French)

The bacteria of fish are very sensitive to variations in pH at 0°C. Lowering the pH of the fish retards bacterial growth.

Correspondingly, lowering the pH also hinders total volatile nitrogen and trimethylamine formation. At pH 5.0 the content of these two bases remained unchanged during the first 25 days of storage at 0°C.

2.01 "BILGY" FISH

Castell, C. H.
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations, No. 58, 27-31 (April, 1954)

(Abstract of this article appears under 2.19 page 7 - August, 1954 issue)

2.01 CHEMICAL INHIBITION OF GROWTH OF FISH SPOILAGE BACTERIA

Tarr, H. L. A.
Journal of the Fisheries Research Board of Canada 6, No. 3, 257-66 (May, 1944)

(Abstract of this article appears under 3.12 page 17)

2.02 STUDIES OF FISH SPOILAGE. VI. THE BREAKDOWN OF CARBOHYDRATES, PROTEINS, AND AMINO ACIDS DURING SPOILAGE OF COD MUSCLE PRESS JUICE

Beatty, S. A. and Collins, V. K.
Journal of the Fisheries Research Board of Canada 4, No. 5, 412-423 (February, 1940)

(Abstract of this article appears under 2.01 page 17)

2.02 HANDLING EFFECT UPON BIOCHEMICAL CHANGE IN THE FISH MUSCLE IMMEDIATELY AFTER CATCH. I. DIFFERENCE OF GLYCOLYSIS IN THE FRIGATE MACKEREL KILLED BY VARIOUS METHODS

Amano, Keishi; Bito, Masamichi; and Kawabata, Toshiharu
Bulletin of the Japanese Society of Scientific Fisheries 19, No. 4, 487-98 (August 25, 1953)
(English summary, tables and figures)

2.02 HANDLING EFFECT UPON BIOCHEMICAL CHANGE IN THE FISH MUSCLE IMMEDIATELY AFTER CATCH. II. CHANGES OF ACID-SOLUBLE PHOSPHORUS COMPOUNDS OF FRIGATE MACKEREL MUSCLE

Fujimaki, Masao and Kojo, Kenzo
Bulletin of the Japanese Society of Scientific Fisheries 19, No. 4, 499-504 (August 25, 1953)

2.19 TRANSPORTING SHRIMPS IN BRITISH COLUMBIA

Anonymous
Canadian Fisherman 41, No. 7, 22 (July, 1954)

(Abstract of this article appears under 2.08 page 15)

2.19 FISH RESEARCH

Anonymous
Food Manufacture 29, No. 6, 223-224 (June, 1954)

(Abstract of this article appears under 3.234 page 3 - September, 1954 issue)

2.19 RECENT DEVELOPMENTS IN FISH HANDLING FROM SEA TO PACKAGE

Castell, C. H.
Canadian Fisheries Annual, 53-55 (1954)

3.230 REVISED U.S. FROZEN FISH SPECIFICATIONS PUBLISHED

Anonymous
Frosted Food Field 18, No. 5, 6 (May, 1954)

3.230 NFI TOPICS: FISH STICKS, TUNA AND REEFER SHIPS

Anonymous
Food Engineering 26, No. 6, 235-236 (June, 1954)

(Abstract of this article appears under 9.2 page 3)

3.231 FIVE MODERN FLOATING FISH FREEZING PLANTS

Kramhoft, O. and Schott, E.
Modern Refrigeration 57, No. 674, 188-189 (May, 1954)

(Abstract of this article appears under 2.118 page 9)

3.231 DEFROSTING LOW TEMPERATURE FREEZERS

Josleyn, H. Nye
National Provisioner 130, No. 24, 33 (June 12, 1954)

4.69 STUDIES ON THE ANTIOXYGENIC PROPERTIES OF WHEAT GERM PHOSPHATIDES

Privett, O. S. and Quackenbush, F. W.
American Oil Chemists' Society 31, No. 5, 169-171 (May, 1954)

Oxygen absorption by highly purified wheat germ phosphatides proceeded without the accumulation of titratable peroxides and without the liberation of free (water-extractable) phosphoric acid. Polymers appeared to be the chief product of the oxidation.

4.69 REACTIONS OF PHOSPHORUS ACID IN THE AUTOXIDATION OF FATS

Privett, O. S. and Quackenbush, F. W.
Journal of the American Oil Chemists' Society 31, No. 6, 225-227 (June, 1954)

(Abstract of this article appears under 4.21 page 11 - September, 1954 issue)

4.69 A STUDY OF THE ANTIOXIDANTS OF NATURAL SPICES

Chipault, J. R.
Hormel Inst., University of Minnesota Annual Report, 25-30 (1951-1952)
Chemical Abstracts 48, No. 7, 4145 (1954)

4.89 THE APPLICATION OF FATTY CHEMICALS TO FLOTATION

Baarson, Robert E. and Parks, John R.
Journal of the American Oil Chemists' Society 31, No. 6, 261-66 (June, 1954)

4.90 SOME RECENT STUDIES ON FAT DIGESTION AND ABSORPTION

Reiser, Raymond
Journal of the American Oil Chemists' Society 31, No. 7, 292-95 (July, 1954)

4.90 COMPARISON OF THE NUTRITIVE VALUES OF MONO-, DI-, AND TRIGLYCERIDES BY A MODIFIED PAIR-FEEDING TECHNIQUE

Harris, Robert S. and Sherman, Henry
Food Research 19, No. 2, 257-262 (March/April, 1954)

Male weanling rats were fed mono-, di-, and triglycerides and a mixture of these fats as 15% and 25% of a synthetic-type diet, and as 15% of a diet of natural foods, for 70 days on an equi-caloric, restricted, pair-feeding basis. No significant difference in body weight increase or caloric efficiency was observed and these fats appear to be nutritionally equivalent, calorie for calorie.

6.3 CHEMICAL STUDIES ON ALGAE--I. ON THE SODIUM α-(α-D- MANNOSIDO)-D-GLYCERATE OBTAINED FROM DIGENIS SIMPLEX AG.

Kawaguchi, Kazuhiro; Yamada, Syozo; and Miyama Syuken
Bulletin of the Japanese Society of Scientific Fisheries 19, No. 4, 481-86 (August 25, 1953) (English summary, figures and tables)

6.3 ALGINIC ACID SULFATE AND ITS SALTS

Alburn, Harvey E.
U. S. Patent 2,638,469 (May 12, 1953)
Chemical Abstracts 47, No. 16, 8325 (1953)

A method is decribed for production of an improved, constant mol-wt. product for use as a blood anticoagulant.

6.3 FOODS OR FODDER FROM MARINE ALGAE

Desparmet, E.
French Patent 976,665 (March 21, 1951)
Chemical Abstracts 47, No. 12, 6069 (1953)

6.190 SOME PROPERTIES OF THE CHICK GROWTH INHIBITOR IN LINSEED OIL MEAL

Kratzer, F. H.; Williams, D. E.; Marshall, Blanche; and Davis, P. N.
Journal of Nutrition 52, No. 4, 555-563 (April 10, 1954)

Water treatment and autoclaving were effective in destroying the growth depressing factor while dry heat was ineffective.

6.190 GROWTH INHIBITORS. EFFECT OF SOYBEAN INHIBITORS ON GROWTH OF TRIBOLIUM CONFUSUM

Lipke, Herbert; Fraenkel, G. S.; and Liener, Irvin E.
Journal of Agricultural and Food Chemistry 2, No. 8, 410-14 (April 14, 1954)

6.190 CONDENSED WHALE SOLUBLES AS PIG FOOD

Dammers, J.
Conserva 1, 202-3 (1952)
Chemical Abstracts 47, No. 6, 2901 (1953)

7.611 VITAMIN A IN FISH LIVER: AN IMPROVED METHOD FOR VITAMIN A DETERMINATION IN FISH LIVER

Martin Perez, C. S.
Inform. quim. anal. (Madrid) 7, 1-2 (1953)
Chemical Abstracts 47, No. 14, 7163 (1953)

To a 4-g. sample of minced liver is added 12 g. of pulverized KOH. The mixt. is ground in a previously chilled mortar. The digest is mixed with 16 g. of defatted wheat flour and the mixt. is transferred to a column and extd. with peroxide free Et_2O until 100 ml. have passed through the column. A 5-ml. aliquot is transferred to a 50-ml. dish and the solvent removed in vacuo. The residue is taken up in EtOH and the absorption detd. at 325, 310, and 334 mμ. The detn. requires less than 70 min. The results are in good agreement with those of other methods.

7.611 DETERMINATION OF VITAMIN A IN COD-LIVER OIL

Swann, R. V.
J. Pharm. and Pharmacol. 4, 886-97 (1952)
Chemical Abstracts 47, No. 4, 1896 (1953)

7.611 SPECTROPHOTOMETRIC DETERMINATION OF THE POTENCY OF VITAMIN A PREPARATIONS SHOWING ABNORMAL ULTRAVIOLET ABSORPTION CURVES

Halse, M.
Medd. Norsk Farm. Selskap 15, 45-68 (1953)
Chemical Abstracts 47, No. 21, 11655 (1953)

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Food Preservation Quarterly
Food Processing
Food Research
Food Science Abstracts
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Foreign Commerce Weekly
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Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Home Economics
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Meldinger Fra SSF (Herring Industry, Norway)
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Pan American Fisherman
Poultry Science
Practical Home Economics
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Southern Fisherman
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above listed publications are included. Biological papers are generally omitted.

7.81 CHEMICAL STUDIES ON THE FRESHNESS OF WHALE MEAT. I. EVALUATION OF THE FRESHNESS AND CHANGES IN QUANTITY OF VARIOUS FORMS OF NITROGEN IN WHALE MEAT BY DETERIORATION

Nakai, Tadashi
J. Pharm. Soc. Japan 68, 168-72 (1948)
Chemical Abstracts 47, No. 16, 8280 (1953)

Changes in the quantity of N during decreasing freshness at room temp. (20-22°) was followed by volatile basic, nonprotein, formol titration, trimethylamine and trimethylamine oxide N.

7.81 THE BACTERIAL REDUCTION OF TRIMETHYLAMINE OXIDE TO TRIMETHYLAMINE

Tarr, H. L. A.
Fisheries Research Board of Canada 4, No. 5, 367-377 (February, 1940)

(Abstract of this article appears under 2.01 page 17)

7.81 FUNDAMENTAL STUDIES ON THE DETERMINATION OF VOLATILE BASIC NITROGEN BY AERATION METHOD. IV. SPECIAL FACTORS AFFECTING THE VELOCITY CONSTANT IN REMOVING THE VOLATILE BASE (2)

Kawabata, Toshiharu
Bulletin of the Japanese Society of Scientific Fisheries 19, No. 7, 819-23 (November, 1953)
(English summary, tables and figures)

8.59 THE BILE OF THE TUNA FISH (THUNNUS THYNNUS)

Castells, Jose and Pascual, Jose
Rev. espan. fisiol. 9, 77-80 (1953)
Chemical Abstracts 48, No. 5, 2928 (1954)

The bile of the tuna fish was found to contain 1.7 g. pure cholesterol and 19 g. pure cholic acid in one l. No other bile acid could be characterized.

8.59 INSULIN CONTENT OF WHALE PANCREAS

Joepes, J. Erik
Norske Videnskaps-Akad. i Oslo, Hvalradets Skrifter 35, 5-15 (1950)
Chemical Abstracts 47, No. 7, 3523 (1953)

8.59 PRESENCE OF CITRIC ACID IN THE SHELLS OF GASTROPODS AND CEPHALOPODS

Creac'h, Paul V.
Compt. rend. soc. biol. 147, 671-3 (1953)
Chemical Abstracts 48, No. 4, 2268 (1954)

8.64 EXAMINATION OF SOME INDUSTRIAL FISH AND WHALES AS TO CONTENT OF VITAMINS B_1 AND B_2

Novikova, E. I.
Rybnoe Khoz. 28, No. 11, 57-60 (1952)
Chemical Abstracts 47, No. 16, 8320 (1953)

Vitamins B_1 and B_2 are found in the liver of fish (up to 5γ of B_1 and 2.5 of B_2), in the internal organs (up to 4γ and 4.7γ, resp.) and in the eyes (up to 18γ and 15.5γ, resp.). These vitamins are almost absent in the fish musculature. Codfish from northern areas contain more vitamins B_1 and B_2 than the specimens from warmer areas. The liver of Antarctic whales contains up to 7γ thiamine per g., while Black Sea dolphin liver contains up to 2 γ/g. of B_1 amd 13 γ/g. of B_2. The pyloric organs of sea perch and related fish contain up to 500 γ/g. vitamin A.

8.64 VITAMINS IN WHALE LIVER

Braekkan, Olaf R.
Norske Videnskaps-Akad. i. Oslo, Hvalradets Skrifter 32, 5-25 (1948)
Chemical Abstracts 47, No. 7, 3523 (1953)

8.64 MICROBIOLOGICAL INVESTIGATIONS ON ANTIPERNICIOUS ANEMIA FACTORS IN THE FISH TAPEWORM

Nyberg, Wolmar
Acta. Med. Scand. 144, Suppl. No. 271, 68 (1952)
Chemical Abstracts 47, No. 5, 2294 (1953)

8.7 EXAMINATIONS OF SAMPLES OF PURE FISH LIVER OIL, 1937 - 1946

Notevarp, O.; Bratland, A.; and Bjorsvik, E.
Fiskeridir. Skr., Ser. Undersok. Fiskeridir. kjem-tek. Forskningsinst. 1, No. 7, (1950) 129 pp.
Food Science Abstracts 25, No. 5, 512 (September, 1953)

The blue value, free fatty acid content, Kreis value, and refractive index of 437 samples of Norwegian cod liver oil were examined. Other data, e.g. weight of the fish, liver content, and oil yields, are also presented.

8.7 REFRACTION (n_D^{20}) OF THE UNSAPONIFIABLE MATTER OF GADUS LIVER OILS

Aure L. and Troen, E.
Fiskeridir. Skr., Ser. Tek. Undersok 1, No. 11, (1951) 11 pp.
Food Science Abstracts 25, No. 5, 513 (September, 1953)

8.7 REFRACTIVE INDEX OF THE UNSAPONIFIABLE MATTER OF PURE GADUS LIVER OILS

Aure, Lars and Troen, Edward
Fiskeridirektorat. Skrifter 1, No. 11, 3-11 (1951)
Chemical Abstracts 47, No. 16, 8313 (1953)

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